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Computer Science for All: Everyone can Thrive in The World of Technology

Senior Project

In partial fulfillment of the requirements for
The Esther G. Maynor Honors College
University of North Carolina at Pembroke

By

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March 17, 2019

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Abstract

In the year 1985, Computer Science and Information Technology classes were very new and different than other STEM disciplines of that time period. Women back then can be seen in these fields more so than in 2005, about twenty (20) years after. There are some factors researchers found that can be related to the decline in women's interest in the technology world. This paper will go into more depth regarding women in the technical world ranging from the year 1985 to 2016. The presence of a gender gap and less diversity in the workplace can lead to lower production rates, creativity and overall knowledge of the group or organization. This research will investigate the issue of women not having not having much interest in the world of technology.

Computer Science for All: Everyone can Thrive in The World of Technology

1. Introduction

Once men and women graduate from high school, some of them choose industry over higher education. However, for those that chose higher education, there are many ways to expand their knowledge. In this study, we will be looking into what STEM means, what fields are included in it and, whether there are any significant differences in enrollments for certain category of students (for example, gender-wise), and if so, the reasons behind these differences. The focus is to discuss the number of students in Computer Science and Information Technology, who is and who is not majoring in them along with why they made these decisions. The abbreviation S.T.E.M stands for Science, Technology, Engineering, and Mathematics. The fields associated with STEM are in the name itself; however, this paper will focus more on the Computer Science and Information Technology fields. Looking at only the two previously mentioned fields, there is an obvious gender gap. There are more men taking these majors than women, by a large margin. What are driving women away from wanting to major in these fields and what are some ways to make them more attractive to women? These are the questions we hope to answer in this paper. At the University of North Carolina at Pembroke (UNCP), there is a clear difference in the men and women taking both Computer Science and Information Technology, however, there are more women taking Information Technology than Computer Science at UNCP. Being a student at UNCP, this can be seen firsthand. Based on my observation, the ratio of women to men is roughly 1 to 5. There has always been at least one woman in every class that I have taken. We will investigate whether the way women are exposed to these majors is the reason for them not wanting to choose Computer Science and Information Technology as their major.

2. Computer Science and Information Technology

Computer Science, also known as CS, is the study of processes that interact with data and that can be represented as data in the form of programs. It enables the use of algorithms to manipulate, store, and communicate digital information (WordNet Search – 3.1). While Information Technology, also known as IT, is the use of computers to store, retrieve, transmit, and manipulate data, or information, often in the context of a business or other enterprise (Daintith, 2009). The main difference between these two majors at UNCP are math, when looking at courses taken. CS has double the math and with less CS courses (CSC) while IT have only a few math classes and more CSC and IT courses (ITC) that involved hands-on work and coding. When comparing what type of work a student can look forward to after graduation, CS graduates, also called computer scientists could be working with mathematics, and software design, when compared to an IT graduate who could be installing software, maintaining networks and databases. In this study, we try to investigate, knowing what a job can consist of, and what the course work could look like, how many students pick one of these technology-based majors?

Going back to the years 1980s to 2005, the percentage of women receiving their undergraduate degrees in computer science has declined to 22% in 2005 from 37% in 1985 (Klawe, 2009, pp. 68-76). According to a teacher survey in 2007 of high school

students, both men and women have a lowered interest in majoring in CS, going to 0.4% in 2006 from 2.8% in 1985 (Klawe, 2009, pp. 68-76). According to Dan Wang (2018) there was a continuous decline from the years 2004 to 2014. These numbers are a bit outdated considering it is 2019 at the making of the paper, however they still hold up today. In the years 1980 – 1990's women were more interested in majoring in computer science than the women of the year 2008 (Stross, 2008). Something happened in the years 2000 to 2008 that made women less interested in CS. With what happened, there are some ideas that could explain the decline. Before, getting into what could have caused the decline of interest, let's look at what women are doing in the STEM fields.

Just because women are less interested in CS does not mean they are not in the other STEM fields. The gender gap that was stated to be seen in CS and IT can also be observed in the other STEM fields, however, the overall gender gap has been increasingly getting better or smaller throughout the past generations (Reinking, 2018, pp. 148-153). Since 1990, the number of women who are interested in the STEM fields have increased overall. Comparing how women and men perform in these fields in college, women are observed doing just as good and better than their male counterparts (Reinking, 2018, pp. 148-153). In 2009, 71% of all surveyed students said that they would major in a STEM field, but only 30% of them were women (Reinking, 2018, pp. 148-153). With this gender gap, nothing seems to have been done to actively try to increase the number of women into the world of technology. In this study, we try to find out what exactly is stopping women and even men, from taking CS today.

Rewinding back to what was mentioned in the second paragraph, the ideas behind what is making women choose against majoring in CS or IT are gender stereotypes. There are about three theories behind what are driving women out of CS and IT. One of the theories are how society sees women compared to how they see men in the STEM fields (Beaubouef, 2005, pp. 103-106). Socialization in both adulthood and childhood (how boys are good at math and women are good in the kitchen) is another theory. The peer groups by each individual student in the academic world could largely impact the way women act, their classes, and what they do outside of class. Lastly, another theory relates to how the people in the STEM fields are preserved, meaning the characteristics and personality traits of the professionals who are working in the field of technology (Beaubouef, 2005, pp. 103-106). The theories listed here are not the only possible causes for driving women out of the world of technology.

3. Women in Technology

Having women and other underrepresented groups are important to every field not just the technology field. Having diversity enhances the abilities needed to perform tasks, greater creativity, and better overall decision making and outcomes (Klawe, 2009, pp. 68-76). The demand for computer scientists has increased by 37% between 2006 and 2016. However, the number of women in the field has fluctuated and efforts need to be made to fulfill the demands. The main two (2) positions that women are obtaining a job in is leadership and representatives in hierarchies of the organization they are working for (Klawe, 2009, pp. 68-76). This is a good direction working towards a future of equal representation in the workplace for women. Before women get into the industry, they must get through undergraduate and graduate school.

The number of women choosing CS for their undergraduate degree has increased along with women in STEM, women choosing CS for their graduate degree, masters, and doctorate levels. This increase also includes international women from Asia, India, The Middle East and Greece, just to name a few. While undergraduate level degrees are concerned the number of women that major in CS was 7,063 in 1995 which increased to 11,235 in 2005 (Klawe, 2009, pp. 68-76). The percentage of women going to graduate school for CS increased to 12,061 in 2005 from 9,881 in 1997. Women that got awarded their master's degree in CS increased to 28.5% in 2005 from 26.4% in 1997. Finally, the percentage of women that was awarded their doctoral in computer science increased to 19.8% in 2005 from 16.5% in 1997 (Klawe, 2009, pp. 68-76). Regarding the numbers of women in all the STEM programs the percentage of women make up about 44.4% of math, which is doubled the technology percentage, being 22.2%. Most of the international locations that women are becoming more interested in and moving forward in the technology fields are Asia, India, The Middle East, Western Europe, Portugal, Finland, Greece, Italy, and Mexico. The overall international percentage of women choosing a STEM field for their undergraduate degree is over 30% (Klawe, 2009, pp. 68-76).

Once men and women graduate from university, the next step is either more education or Industry. Looking at some statistics for women in the technology industry, the percentage of women in a profession related to CS is 10.9% as of 2007 which was an increase from 5% (Klawe, 2009, pp. 68-76). The overall hire rate for women in the US increased to 24% in 2007 from 18% in 1997 (Klawe, 2009, pp. 68-76). Everything stated above appears to be looking positive that women are having an increased interest in the technology field. However, with the increase in numbers over the STEM fields and the increase in all the levels of higher education but they are still underrepresented when compared to men in these fields doing the same jobs and taking the same classes. With all the new technology we have today, some of the numerous ways that could help get women more interested in technology fields are found in the next paragraph.

Some ways to help include more women in the world of technology could be having some role models be more apparent in the modern world by means of social media, news services, school speakers and more. Having an organization that created the Women's Empowerment program do something similar for the women who are successful in the technical world. Having public high schools add CS and/or IT classes that are mandatory to take for all students so everyone can have an equal opportunity. Another way could be making technology classes and services more appealing to women by making video games more attractive to women and by making CS and IT feel like it is for everyone by not just making it seem masculine. These methods to help get more women into the world of technology are not the only ways to get women interested, however these can lead us in the right direction for making CS and IT fields more gender diverse.

4. The Future of Women in Technology

After the research, we strongly believe there is a future for women in the field of technology. There is a holiday dedicated to women in STEM fields, called "Ada Lovelace Day" or ALD. This holiday was named after one of the first successful women in computing, Augusta Ada King-Noel, Countess of Lovelace, or Ada Lovelace. ALD is held yearly on the second Tuesday of October and is a day to celebrate all the women who

are in the STEM fields, Ada Lovelace herself is known for mathematics and computing. Having more women and more knowledge of this day spread and be made more known to the public could help get more interested in the field of technology.

Conclusion

To conclude this research paper, we would like to go over some research questions that helped with the creation of this paper. One of the major questions we wanted to ask is why are women not as interested in CS and IT as men are? Research showed that the way females are brought up, along with the lack of a female role model and their peer groups can be some of those reasons. What are keeping women from wanting to major in CS or IT? The way women are exposed to these fields are tremendously different from the way men are, women are taught to be good in the kitchen are given dolls to play with as children while men are given video games and Legos. Legos help with creativity and problem solving depending on the type of Lego build. With the gender difference in STEM fields, the gap is more apparent in the technology fields such as CS and IT. Being a CS major the classrooms are mostly men. However, every year since 2015, there have been more women in the CS and IT class, at least at the UNCP. Some of the reasons that are pushing women away from majoring in CS or IT in undergraduate programs is because they are not interested in technology enough to major in it or they have taken technology classes in the past and did not have the drive or passion to stay in that major. Women do have a future in the world of technology, but something must change to attract them and to keep them interested. Some ideas that could help are:

- a. Have some role models that are in the world of technology that college and high school women would want to be like or look up to.
- b. Be exposed to technology at a younger age so they can be as experienced as men according to research, boys are the ones that are pushed towards technology while girls are pushed towards cooking.
- c. Have some CS and IT classes offered in high school as beginner classes so everyone can get a taste of what it would be like to major in it in college.

The goal of this paper is to help the readers try to get the word out to women that they can succeed in the world of technology and that women can perform just as good, even better than men in the same classes. Women can succeed in the world of technology.

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